

CECW-ED

**DEPARTMENT OF THE ARMY  
U.S. Army Corps of Engineers  
Washington, DC 20314-1000**

ETL 1110-2-343

Engineer Technical Letter  
No. 1110-2-343

31 May 1993

**Engineering and Design  
STRUCTURAL DESIGN USING THE ROLLER-COMPACTED  
CONCRETE (RCC) CONSTRUCTION PROCESS**

**1. Purpose**

This engineer technical letter (ETL) provides guidance for design engineers considering roller-compacted concrete (RCC) as a cost-saving alternative for civil works structures.

**2. Applicability**

This ETL applies to all HQUSACE elements, major subordinate commands, districts, laboratories, and separate field operating activities having civil works responsibilities for the design of civil works projects.

**3. References**

- a.* EM 1110-2-2000, Standard Practice for Concrete.
- b.* EM 1110-2-2006, Roller Compacted Concrete.
- c.* Draft EM 1110-2-2200, Gravity Dam Design.
- d.* ETL 1110-2-324, Special Design Provisions for Massive Concrete Structures.
- e.* ACI Committee 207, Roller Compacted Concrete, 207.5R, ACI Materials Journal, September - October 1988.
- f.* ACI Committee 210, Erosion of Concrete in Hydraulic Structures, ACI 210R-87, ACI Materials Journal, March - April 1987.
- g.* Heaton, B. S. 1968 (Oct). Strength, Durability and Shrinkage of Incompletely Compacted Concrete, pp 846-850.

**4. Purpose**

RCC has developed over the past 20 years in response to the need to provide more economical mass concrete structures that can be constructed rapidly. RCC is replacing conventional mass concrete as the primary construction material for gravity dams and has become a viable alternative material for structures other than dams. The enclosed guidance (Enclosure 1) also provides design engineers with material considerations for RCC to assure that the completed structure meets strength and serviceability requirements. The enclosure includes:

- a.* Structural design guidance for RCC structures.
- b.* Examples of past usage and the types of structures suited to RCC construction.
- c.* Similarities and differences with respect to conventionally placed mass concrete.
- d.* The structural engineer's role in the testing and construction processes.
- e.* Construction processes and features unique to RCC construction.
- f.* Material properties that affect strength, serviceability, durability, impermeability, and density.
- g.* Processes and procedures necessary to establish accurate strength parameters for design.

## 5. Recommendations and Requirements

*a.* Once strength and serviceability requirements for the RCC have been established by the structural designers, in accordance with EM 1110-2-2006, the structural design engineer should work with material engineers and the material testing laboratory to establish suitable mix designs, a comprehensive laboratory and field testing program, and a quality assurance program to assure that the in-place RCC meets the design requirements.

*b.* Hydraulic structures require concrete that is durable and watertight, with moderate to high bond strength. To assure that the RCC will have these properties, the mix design should have:

(1) Adequate paste and mortar to fill all aggregate voids.

(2) High slump mortar bedding on all lift joint surfaces.

(3) Aggregates meeting the standards for quality and grading as required for conventionally placed concrete.

Conventional concrete should be provided for regions where the RCC would be exposed to flowing water with velocities exceeding 25 fps and/or when flows are of significant duration and frequency to cause erosion and maintenance

problems. Air-entrained conventional concrete should also be provided in all regions where the surface of the structure would be exposed to freeze-thaw cycles while critically saturated.

*c.* When RCC is used for massive concrete structures, the design objectives of ETL 1110-2-324, "Special Design Provisions for Massive Concrete Structures" should be considered and a nonlinear structural analysis performed where required to meet design objectives.

*d.* Test placements during the mixture design phase and during the initial phase of construction are needed to verify adequacy of the mixture ingredients, mixture proportions, and construction techniques.

*e.* Consultation with and approval by CECW-E is required when selecting consultants outside the Corps of Engineers for recommendations on RCC design and construction practices.

*f.* The special uplift and sliding stability requirements of Section 9 of the enclosure shall be followed when designing RCC gravity dams.

*g.* A Post-Construction Structural Report should be submitted as outlined in Section 9d of the enclosure.

FOR THE DIRECTOR:

1 Encl



PAUL D. BARBER, P.E.  
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